Final Revision — Part (1) — Cost of Capital — Jan. 2016

p22 جاي

« Summary »

Capital structure (long term sources of fund)

- Debt
  - Bonds
- Equity
  - preferred
  - Common
    - Retained earning
    - New issuance

★ Cost of debt (r_d) = $\dfrac{I + \frac{Par - N_d}{n}}{\frac{N_d + Par}{2}}$

I : Interest (coupon) = Par value x Coupon rate

N_d : Net proceeds from the bond = par + premium − flotation cost
= par − Discount − flotation cost

After tax Cost of debt (r_i) = $r_d(1-T)$ where T is the tax rate.

★ Cost of preferred equity (r_p) = $\dfrac{D_p}{N_p}$

D_p : Dividend paid for preferred stock = par value X Dividend rate

N_p : Net proceeds from preferred stocks = price − flotation

★ Cost of Common equity (r_s) :

Cost of retained earnings

$r_r = \dfrac{D_1}{P_0} + g$

D_1 : the dividends for the next year

$D_1 = D_0(1+g)$

g : The constant growth rate

P_0 : is the Current market price

Cost of new issuance

$r_n = \dfrac{D_1}{N_n} + g$

N_n : The net proceeds from the sale of new stocks

N_n = price − underpricing − flotation

Also, we can calculate the cost of retained earnings using CAPM :

$$r_r = R_F + b\,(r_m - R_F)$$

* Weighted Average Cost of Capital : (After tax Cost of Capital)

$$WACC = w_i r_i + w_p r_p + w_s r_{(s) \text{ or } (n)}$$

w_i : weight of debt in the Capital structure $= \frac{\text{Debt}}{\text{Total Capital}}$

w_p : " " preferred equity

w_s : " " Common "

« Solutions to selected problems »

problem (1) :

Currently, a firm can sell 15-year, $ 1000 par value bonds paying annual interest at a 12% coupon rate. As a result of current interest rates, the bonds can be sold for $ 1010 each; flotation costs of $ 30 per bond will be incurred in this process. The firm is in the 40% tax bracket. Calculate the after-tax cost of debt.

Solution (1) : $I = 1000 \times 12\% = \$ 120$

$N_d = 1010 - 30 = \$ 980$

$$r_d = \frac{I + \frac{par - N_d}{n}}{\frac{N_d + par}{2}} = \frac{120 + \frac{1000 - 980}{15}}{\frac{980 + 1000}{2}} = 12.25\%$$

After tax cost of debt $r_i = r_d(1 - T) = 12.25\%\,(1 - 40\%)$

$= 7.35\%$

problem (2)

A corporation asked its financial manager to calculate its weighted average cost of capital given the following data :

- The firm can sell for \$980 a 10-year, \$1,000-par value bond paying annual interest at a 10% coupon rate. A floatation cost of 3 % of the par value is required in addition to the discount of \$20 per bond.
- Eight percent (annual dividend) preferred stock having a par value of \$100 can be sold for \$65. An additional fee of \$2 per share must be paid to the underwriters.
- The firm's investment advisors and its own analyses indicate that the risk free rate equals 7%, the firm's beta equals 1.5, and the market return equals 11%.
- The tax rate is 40 percent.
- The proportion of long-term debt in capital structure is 40 percent.
- The proportion of preferred stock in capital structure is 10 percent.

Solution (2) :

- Bond : par = \$1000 n = 10 $I = 1000 \times 10\% = \$100$

$N_d = 980 - (3\% \times 1000) = \$950$

$$r_d = \frac{100 + \frac{1000 - 950}{10}}{\frac{950 + 1000}{2}} = \frac{105}{975} = 10.76$$

After tax Cost of debt $r_i = 10.76 (1 - 40\%) = 6.45\%$

- preferred stock : par = \$100 Dividends $D_p = 8\% \times 100 = \$8$

$N_p = 65 - 2 = \$63$

Cost of preferred stock $r_p = \frac{D_p}{N_p} = \frac{8}{63} = 12.69\%$

- Common Stock : $R_F = 7\%$ $b = 1.5$ $r_m = 11\%$

Cost of retained earnings $r_r = R_F + b(r_m - R_F)$

$= 7\% + 1.5(11\% - 7\%) = 13\%$

$WACC = w_i r_i + w_p r_p + w_s r_r$

$= (40\% \times 6.45) + (10\% \times 12.69\%) + (50\% \times 13\%) = 10.349\%$

problem (3):

A company has a capital structure consists of 30% debt, 20% preferred equity, and 50% common equity. The following data are collected about this company:

Debt: The firm can sell $1000 par, 8% coupon rate, 20 year bonds at $30 discount per bond. The firm must also pay flotation costs of $30 per bond.

preferred stock: The firm can sell 8% preferred stock at its $95 per share par value. The cost of issuing and selling the preferred stock is $5 per share.

Common stock: The firm's common stock is currently selling for $90 per share. The firm expects to pay cash dividends of $7 per share next year. The firm's dividends have been growing at an annual rate of 6%. The stock must be underpriced by $7 per share and flotation costs are $5 per share.

→ Assume 40% tax rate, what is the after tax cost of capital?

Solution (3):

$$\text{Cost of debt } (r_d) = \frac{I + \frac{Par - N_d}{n}}{\frac{N_d + Par}{2}} = \frac{80 + \frac{1000 - 940}{20}}{\frac{940 + 1000}{2}} = 8.55\%$$

- After tax Cost of debt $r_i = 8.55\% (1 - 40\%) = 5.13\%$
- Cost of preferred stock $r_p = \frac{D_p}{N_p} = \frac{8\% \times 95}{95 - 5} = \frac{7.6}{90} = 8.4\%$
- Cost of Common stock $r_n = \frac{D_1}{N_n} + g = \frac{7}{(90 - 7 - 5)} + 6\% = 15\%$
- $WACC = W_i r_i + W_p r_p + W_s r_n$

$= (30\% \times 5.13\%) + (20\% \times 8.4\%) + (50\% \times 15\%) = 10.71\%$

problem (4):

Assume that :

1. The target weights for the financial structure are 0.40 long term debt, 0.10 preferred stock and 0.50 common stock equity.
2. The cost of long term debt after tax is 5.6 %.
3. The cost of preferred stock is 10.6 %.
4. The market price of common stock is $ 50 per share.
5. The expected dividend on stock is $ 4.
6. The expected growth rate is 0.05
7. The total underpricing and flotation costs per new share are $ 10.

Required

(a) what is the weighted Average Cost of Capital (WACC)?

(b) what is the weighted Marginal Cost of Capital (WMCC) if the expected retained earnings = $ 30 000 ?

Solution

$w_i = .40$ $w_p = .10$ $w_s = .50$

$r_i = 5.6\%$ $r_p = 10.6\%$

$$r_r = \frac{D_1}{P_0} + g = \frac{4}{50} + .05 = 13\% \quad \text{(Retained Earnings)}$$

$$r_n = \frac{D_1}{N_n} + g = \frac{4}{50-10} + .05 = 15\% \quad \text{(New issuance)}$$

→ WACC using retained Earnings :

$= w_i r_i + w_p r_p + w_s r_r$

$= (.40 * 5.6\%) + (.10 * 10.6\%) + (.50 * 13\%) = \boxed{9.8\%}$

as the amount of expected retained earnings = $ 30 000 only, the amount of total capital structure using retained earnings = $\frac{30\,000}{50\%} = \$ 60\,000$

→ If the capital structure is greater than $ 60 000, the marginal Cost of Capital = $w_i r_i + w_p r_p + w_s r_n$

$= (.40 * 5.6\%) + (.10 * 10.6\%) + (.50 * 15\%) = \boxed{10.8\%}$

Replacement

3 types of cash flows related to the replacement decision:

1- **Initial investment**= Installed cost of new asset + Change in net working capital - After-tax proceeds from sale of old asset.

- Installed cost of new asset =total Cost of new asset+ shipping+ installation+ insurance
- Change in net working capital= change in current assets- change in current liabilities ($\Delta NWC = \Delta CA - \Delta CL$)
- After-tax proceeds from sale of old asset= Proceeds from sale of old asset+ or - Tax on sale of old asset

2- **Incremental operating Cash Inflows=**

(ΔRevenue - Δ Expenses – Δ Depreciation)(1- Tax rate) + Δ Depreciation

= ΔEBIT (1- T) + Δ Depreciation

= ΔNOPAT + Δ Depreciation

= ΔEBDIT (1- T) + Δ Depreciation (T)

EBIT : Earning Before interest and Tax

NOPAT : Net operating profit after tax

EBDIT : Earning Before depreciation, interest, and tax

3- **Terminal Cash Flow**= After-tax proceeds from sale of new asset + Change in net working capital - After-tax proceeds from sale of old asset.

- After-tax proceeds from sale of new asset = Proceeds from sale of new asset+ or - Tax on sale of new asset

Note: any sunk costs such as feasibility study cost, are not considered in the replacement decision.

Problem (5) Atlantic Drydock is considering replacing an existing machine with one of two newer, more efficient pieces of equipment. The existing machine is 3 years old, cost $32,000, and is being depreciated under MACRS using a 5-year recovery period. Although the existing machine has only 3 years of depreciation remaining under MACRS, it has a remaining usable life of 5 years. A new machine costs $40,000 to purchase and $8,000 to install. It has a 5-year usable life and will be depreciated under MACRS using a 5-year recovery period.

Purchase of the new machine would result in a $4,000 increase in net working capital.

Earnings before depreciation, interest, and taxes with the new machine are $21000 annually; With existing machine are $14000 annually.

The existing machine can currently be sold for $18,000 and will not incur any removal or cleanup costs. At the end of 5 years, it can be sold to net $1,000 before taxes. The new machine can be sold to net $12,000 before taxes at the end of the 5-year period. The firm is subject to a 40% tax rate.

a. Calculate the *initial investment* associated with the new machine.

b. Calculate the *incremental operating cash inflows* associated with the new machine.

c. Calculate the *terminal cash flow* at the end of year 5.

d. Assume 10% discount rate, would the company replace the existing machine or not?

Solution (5):

Existing (old) machine	new machine
3-year old, Cost $ 32 000	T.Cost = 40 000 + 8000 = 48000
MACRS 5-year	life 5 years MACRS 5-year
Remaining life 5 years	Δ NWC = 4000
EBDIT = $14 000 annually	EBDIT = 21 000 annually
Sale price today = $18000	Sale price after 5-years = $ 12 000
Sale price after 5 years = $ 1000	T = 40%

(a) 1- Book value of old machine = Cost − Accumulated depreciation

= 32 000 − [32 000 × (20% + 32% + 19%)] = 9280

2. Gain = Recaptured depreciation = Sale price − B.V = 18000 − 9280 = 8720

3. Tax liability = 8720 × 40% = $ 3488

4. After Tax proceeds from old machine = 18 000 − 3488 = $ 14 512

→ I_o = Total cost of new machine + Δ NWC − After tax proceeds from old machine

= 48000 + 4000 − 14 512 = $ 37 488

(b)

year	Depreciation of new machine	Depreciation of old machine	Δ (new − old)
1.	48000 × 20% = 9600	32000 × 12% = 3840	5760
2.	48000 × 32% = 15 360	32000 × 12% = 3840	11 520
3.	48000 × 19% = 9120	32000 × 5% = 1600	7 520
4.	48000 × 12% = 5760	0 (Fully depreciated)	5760
5.	48000 × 12% = 5760	0 (Fully depreciated)	5760

→ Incremental operating cash inflows = Δ EBDIT (1 − T) + Δ Dep (T)

Year (1) = (21000 − 14000) × (1 − 40%) + 5760 × 40% = 6504

Year (2) = (21000 − 14000) × (1 − 40%) + 11520 × 40% = 8808

Year (3) = (21000 − 14000) × (1 − 40%) + 7520 × 40% = 7208

Year (4) = (21000 − 14000) × (1 − 40%) + 5760 × 40% = 6504

Year (5) = (21000 − 14000) × (1 − 40%) + 5760 × 40% = 6504

(c) 1. B.V of new machine = $48000 - [48000 \times (20\% + 32\% + 19\% + 12\% + 12\%)]$

$= \$ 2400$

2. Gain (Recaptured dep.) = $12000 - 2400 = 9600$

3. Tax liability = $9600 \times 40\% = 3840$

4. After Tax proceeds from new machine = $12000 - 3840 = \$ 8160$

1. BV of old machine = zero (fully depreciated)

2. Gain (Recaptured dep) = $1000 - 0 = 1000$

3. Tax liability = $1000 \times 40\% = 400$

4. After tax proceeds from old machine = $1000 - 400 = \$ 600$

→ Terminal CF at the end of year (5)

= After tax proceeds from new − After tax proceeds from old + Δ NWC

$= 8160 - 600 + 4000 = \$ 11560$

(d)

0	1	2	3	4	5
(37488)	6504	8808	7208	6504	6504 + 11560

$$NPV = \left[\frac{6504}{(1.1)^1} + \frac{8808}{(1.1)^2} + \frac{7208}{(1.1)^3} + \frac{6504}{(1.1)^4} + \frac{6504 + 11560}{(1.1)^5}\right] - 37488$$

$= -3221.8$

So, the Company should not replace the existing machine

Problem (6) Russell Industries is considering replacing a fully depreciated machine that has a remaining useful life of 10 years with a newer, more sophisticated machine. The new machine will cost $200,000 and will require $30,000 in installation costs. It will be depreciated under MACRS using a 5-year recovery period. A $25,000 increase in net working capital will be required to support the new machine. The firm's managers plan to evaluate the potential replacement over a 4-year period. They estimate that the old machine could be sold at the end of 4 years to net $15,000 before taxes; the new machine at the end of 4 years will be worth $75,000 before taxes. Calculate the *terminal cash flow* at the end of year 4 that is relevant to the proposed purchase of the new machine. The firm is subject to a 40% tax rate.

Solution (6)

- B.V of new machine at the end of year (4) = $230000 - [230000 \times (20\% + 32\% + 19\% + 12\%)]$
  $= \$ 39100$

- Recaptured depreciation = 75000 - 39100 = $ 35900
- Tax Liability = 35900 x 40% = $ 14360
- After tax proceeds from new machine = Sale price - Taxes = 75000 - 14360 = $ 60640

→ B.V of old machine at the end of year (4) = Zero

- Recaptured depreciation of old machine = 15000 - 0 = $ 15000
- Tax liability = 15000 x 40% = $ 6000
- After tax proceeds from old machine = 15000 - 6000 = $ 9000

→ Terminal CF = After tax proceeds from new + Δ NWC - After tax proceeds from old
= 60640 + 25000 - 9000 = $ 76640

(10) " Capital Budgeting "

Economic value Added: (EVA)

Example: Suppose a certain project costs $1,000,000 up front, but after that it will generate net cash inflows each year (in perpetuity) of $120,000. To calculate the NPV of this project, we would simply discount the cash flows and add them up. If the firm's cost of capital is 10%, then the project's NPV is: **NPV** = -$1,000,000 + ($120,000 ÷ 0.10) = $200,000

EVA = project cash flow -[(cost of capital) * (invested capital)]

= $120,000 – (.10 * 1000 000) = $ 120 000 - $100,000 = $20,000

The project produces an annual EVA of $20,000 in perpetuity.

Discounting this at 10% gives a project EVA of $200,000 ($20,000 ÷ .10), identical to the NPV.

Problem (9): A project costs $2.5 million up front and will generate cash flows in perpetuity of $240,000. The firm's cost of capital is 9%.

a. Calculate the project's NPV.

b. Calculate the annual EVA in a typical year.

c. Calculate the overall project EVA and compare to your answer in part a.

Problem (10): A firm can purchase a fixed asset for a $13,000 initial investment. The asset generates an annual after-tax cash inflow of $4,000 for 4 years.

a. Determine the *net present value (NPV)* of the asset, assuming that the firm has a 10% cost of capital. Is the project acceptable? $[PVIFA_{10\%,4} = 3.1699]$

b. Determine the maximum required rate of return that the firm can have and still accept the asset. Discuss this finding in light of your response in part **a.**

Problem (11): Oak Enterprises accepts projects earning more than the firm's 15% cost of capital. Oak is currently considering a 10-year project that provides annual cash inflows of $10,000 and requires an initial investment of $61,450. (*Note:* All amounts are after taxes.)

a. Determine the *IRR* of this project. Is it acceptable?

b. Assuming that the cash inflows continue to be $10,000 per year, how many *additional years* would the flows have to continue to make the project acceptable (that is, to make it have an IRR of 15%)?

c. With the given life, initial investment, and cost of capital, what is the minimum annual cash inflow that the firm should accept?

Problem (12): Benson Designs has prepared the following estimates for a long term project it is considering. The initial investment is $18,250, and the project is expected to yield after-tax cash inflows of $4,000 per year for 7 years. The firm has a 10% cost of capital.

a. Determine the *net present value (NPV)* for the project.

b. Determine the *internal rate of return (IRR)* for the project.

c. Would you recommend that the firm accept or reject the project?

Solution (9): $CF_0 = 2.5$ m. Annual cf = 240 000 perpetuity إلى الأبد

a) $NPV = \frac{CF}{r} - CF_0 = \frac{240000}{9\%} - 2.5m = 2\,666\,666.67 - 2.5m. = 166\,667$

b) Annual EVA = project CF − (Cost of Capital × Invested Capital)

= 240 000 − (9% × 2.5 m.) = $15000

c) The overall project EVA = EVA ÷ r ← perpetuity إلى الأبد

= 15000 ÷ 9% = 166 667

We find that the project EVA = NPV

Solution (10):

0	1	2	3	4
(13000)	4000	———	———	4000

a) $NPV = 4000 \times PVIFA_{10\%,4} - 13000 = -320.4$ (Reject)

b) We have to get the (RRR) that could be used instead of 10% in order to make the NPV = 0, which is the IRR.

→ Assume r = 8% → $NPV = 4000 \times PVIFA_{8\%,4} - 13000 =$ 248.4

8% → 248.4

IRR → ?

10% → −320.4

$$\frac{IRR - 8\%}{10\% - 8\%} = \frac{0 - 248.4}{-320.4 - 248.4}$$

$$IRR = 8\% + \frac{248.4}{248.4 + 320.4}(10\% - 8\%) = \underline{8.87\%}$$

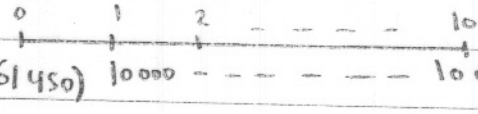
if RRR is greater than 8.87%, the firm will reject the Asset.

So, the Maximum acceptable RRR is 8.87%

Since the firm's Cost of Capital (RRR) is 10% which is greater than 8.87%, the project is rejected.

(12)

Solution (11) :



a) Assume $r = 10\% \rightarrow NPV = 10000 \times PVIFA_{10\%,10} - 61450 = Zero$

So, $IRR = 10\%$

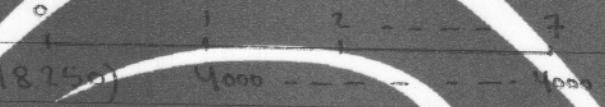
$\therefore$ IRR (10%) < Cost of Capital (15%) So, we reject the project

b) ملغى

c) $CF \times PVIFA_{15\%,10} - 61450 = 0$

$CF \times 5.0188 = 61450 \quad \therefore CF = \$12\,244$

Solution (12) :



a) $NPV = 4000 \times PVIFA_{10\%,7} - 18250$

$= 4000 \times 4.8684 - 18250 = \$1223.6$

b) Assume $r = 10\% \rightarrow NPV = 1223.6$

Assume $r = 15\% \rightarrow NPV = 4000 \times PVIFA_{15\%,7} - 18250 = -1608.4$

r = 10% →	NPV = 1223.6
IRR →	0
15% →	−1608.4

$$\frac{IRR - 10\%}{15\% - 10\%} = \frac{0 - 1223.6}{-1608.4 - 1223.6}$$

$$IRR = 10\% + \frac{1223.6}{1223.6 + 1608.4}(15\% - 10\%) = 12.16\%$$

c) The firm should accept because $NPV > 0$ and $IRR > RRR$

*** Wait for part (2) ....

(13)

problem (13):

Capital Budgeting

A and B are mutual exclusive of equal risk. The firm's cost of capital is 13%. The cash flows for each project are shown in the following table.

	Project A	Project B
Initial investment	$80000	$ 50000
year	Cash inflows	
1	15000	15000
2	20000	15000
3	25000	15000
4	30000	15000
5	35000	15000

a- Calculate the NPV for each project.
b- Calculate the IRR for each project.
c- Assume that the cost of capital is above 14%, which project you would recommend. Explain why.

$PVIFA_{15\%,5} = 3.352$ $PVIFA_{16\%,5} = 3.274$

Solution

(a) NPV_A at 13% $= \left[\frac{15000}{(1+13\%)^1} + \frac{20000}{(1.13)^2} + \frac{25000}{(1.13)^3} + \frac{30000}{(1.13)^4} + \frac{35000}{(1.13)^5}\right] - 80000 = \$\ 3655$

NPV_B at 13% $= (15000 \times PVIFA_{13\%,5}) - 50000 = \$\ 2755$

According to NPV, project A is preferred with higher NPV.

(b) To find IRR for A:

- Assume $r = 13\% \rightarrow NPV_A$ at 13% $= 83655 - 80000 = 3655$
- Assume $r = 16\% \rightarrow NPV_A$ at 16% $=$

$$\left[\frac{15000}{(1.16)^1} + \frac{20000}{(1.16)^2} + \frac{25000}{(1.16)^3} + \frac{30000}{(1.16)^4} + \frac{35000}{(1.16)^5}\right] - 80000$$

$= 77043 - 80000 = -2957$

r	PV	+ NPV
13%	83655	83655
16%	77043	80 000
3%	6612	3655

$$IRR_A = 13\% + \frac{3655}{6612} \times 3\% = (14.6\%)$$

To Find IRR for B :

- Assume $r = 15\%$

NPV_B at 15% = (15000 × PVIFA 15%, 5) − 50 000

= 50 280 − 50 000 = 280

- Assume $r = 16\%$

NPV_B at 16% = (15000 × PVIFA 16%, 5) − 50 000

= 49110 − 50 000 = −890

r	PV	NPV
15%	50 280	50280
16%	49110	50 000
1%	1170	280

$$IRR_B = 15\% + \frac{280}{1170} \times 1\% = (15.2\%)$$

→ According to IRR, project (B) is preferred with higher IRR.

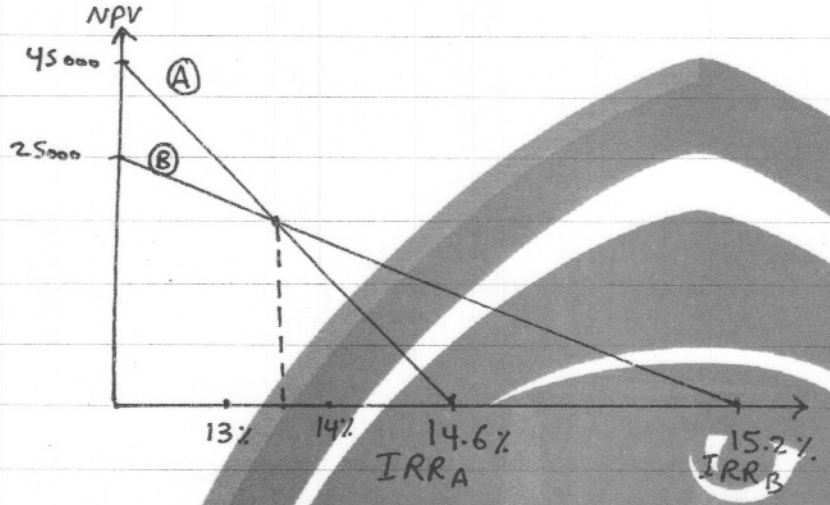
(C) If Cost of Capital above 14% :

NPV_A at 14% = 1361.8 $\qquad$ $IRR_A = 14.6\%$

NPV_B at 14% = 1495 ✓ $\qquad$ $IRR_B = 15.2\%$ ✓

In this Case, our decision will change. we have to select project (B) with higher NPV and higher IRR.

* Assume in the previous problem, you are required to draw the NPV profiles for both projects on the same set of axes and discuss any conflict in ranking that may exist between NPV and IRR.



At 13% Cost of Capital (before cross-over rate):
A Conflict exist between NPV and IRR. According to NPV, we have to select (A) with higher NPV. According to IRR, we have to select (B) with higher IRR.
In this case, we will select project (A) as recommended by NPV because:

1. our objective is to maximize shareholder wealth, which will be achieved through maximizing the value not the rate.
2. NPV assumes that intermediate Cash flows are reinvested at Cost of Capital, while IRR assumes it is reinvested at the project IRR. The more realistic is Cost of Capital assumed by NPV.

So, NPV is preferred over IRR in ranking mutual exclusive projects.

Above 14% Cost of Capital (after Cross-over rate):
No Conflict exist. Select (B) According to NPV and IRR.

(Note) 3 reasons of the Conflict between NPV and IRR:
1. Different reinvestment rate assumptions. 2. Timing of CFs
3. Magnitude (size) of initial investment.

" Risk & Refinement in Capital Budgeting "

problem (14): Assuming the following info. about two projects A and B:

	project (A)	project (B)
Initial investment	100 000	150 000
life	5 years	5 years
Annual cash flows	20 000	50 000
Beta	1	1.5

→ Market rate of return is 10% and Risk free is 6%. Calculate NPV for each project, and explain the underlying Concept.

PVIFA 10%, 5 = 3.791

PVIFA 12%, 5 = 3.605

Solution

projects A and B have different betas which means that they have different risk. So, They have different risk-Adjusted discount rates (RADR).

$RADR_{(A)} = R_F + b(R_m - R_f)$

$= 6\% + 1(10\% - 6\%) = 10\%$

$RADR_{(B)} = 6\% + 1.5(10\% - 6\%) = 12\%$

$NPV_{(A)} = (20\,000 \times PVIFA_{10\%,5}) - 100\,000 = -24\,180$ ✗

$NPV_{(B)} = (50\,000 \times PVIFA_{12\%,5}) - 150\,000 = 30\,250$ ✓

→ Differences in risk should be Considered when evaluating projects by adjusting discount rate used in calculating NPV.

problem (15) :

A firm is considering the purchase of one of three mutually exclusive projects for increasing production efficiency. The firm plans to use a 14% cost of capital to evaluate these equal –risk projects. The initial investment and annual cash inflows over the life of each project are shown in the following table.

	Project X	Project Y	Project Z
Initial ivestment (CF_0)	$78,000	$52,000	$66,000
Year (t)	Cash inflows (CF_t)		
1	$17,000	$28,000	$15,000
2	25,000	38,000	15,000
3	33,000	-	15,000
4	41,000	-	15,000
5	-	-	15,000
6	-	-	15,000
7	-	-	15,000
8	-	-	15,000

a- Calculate the NPV for each project over its life. Rank the projects in descending order on the basis of NPV.

b- Use the annualized net present value (ANPV) approach to evaluate and rank the projects in descending order on the basis of ANPV.

c- Compare and contrast your findings in parts a and b . which project would you recommend that the firm purchase?why?

Remarks

PVIFA $_{14\%,4}$ = 2.914

PVIFA $_{14\%,2}$ = 1.647

PVIFA $_{14\%,8}$ = 4.639

Solution

(a) $NPV_x = \left[\frac{17000}{(1.14)^1} + \frac{25000}{(1.14)^2} + \frac{33000}{(1.14)^3} + \frac{41000}{(1.14)^4}\right] - 78000$

$= \underline{2698}$

$NPV_y = \left[\frac{28000}{(1.14)^1} + \frac{38000}{(1.14)^2}\right] - 52000 = \underline{1801}$

$NPV_z = (15000 \times PVIFA_{14\%,8}) - 66000 = \underline{3585}$

In descending order :

NPV y	1801	2 years
NPV x	2698	4 years
NPV z	3585	8 years (The best)

on the basis of NPV, project z is preferred with the highest NPV.

(b) $ANPV_x = \frac{2698}{PVIFA_{14\%,4}} = 926$

$ANPV_y = 1801 \div PVIFA_{14\%,2} = 1094$

$ANPV_z = 3585 \div PVIFA_{14\%,8} = 773$

In descending order :

ANPV z	773	8 years
ANPV x	926	4 years
ANPV y	1094	2 years (The best)

on the basis of ANPV, project y is preferred with the highest ANPV.

(c) According to NPV, project z is preferred
" " ANPV, " y is preferred

In case of evaluating projects with unequal Lives, NPV is not appropriate technique.
The appropriate criterion used in evaluating projects with unequal Lives is ANPV.
So, we have to select project (y) with the highest ANPV.

← انظر درس الشرح في الجزء "Refinement in Cap. Bud." مثال (٣) ص (٢٥)

Ch(13) Leverage

Income statement

Sales	$Q \times P$	
Less : Variable Cost	$(Q \times Vc)$	operating Leverage (DoL)
Less : Fixed Cost	(FC)	
EBIT	$= Q(P-Vc)-Fc$	
Less : Interest	(I)	
Earning befor Tax		
Less : Tax	(T)	Financial leverage (DFL)
Net profit after Tax		Degree of Financial leverage
Less : preferred dividends	(PD)	
Earning available for Common		
÷ number of shares		
Eps		

Total Leverage (DTL)

$$DoL = \frac{\% \Delta \text{ EBIT}}{\% \Delta \text{ Sales}} = \frac{Q(P-Vc)}{Q(P-Vc)-Fc}$$

$$DFL = \frac{\% \Delta \text{ EPS}}{\% \Delta \text{ EBIT}} = \frac{Q(P-Vc)-Fc}{Q(P-Vc)-Fc-I-\left(\frac{PD}{1-T}\right)} = \frac{EBIT}{EBIT-I-\left(\frac{PD}{1-T}\right)}$$

$$DTL = \frac{\% \Delta \text{ EPS}}{\% \Delta \text{ Sales}} = DoL \times DFL = \frac{Q(P-Vc)}{Q(P-Vc)-Fc-I-\left(\frac{PD}{1-T}\right)}$$

Break even $= \frac{Fc}{P-Vc}$

problem (16): A Company is currently selling 30 000 units at $6 per unit. Variable Cost per unit = $3.5. Fixed operating Costs = $50 000 per year. Interest = $13 000. preferred dividends = $7000. Tax rate = 40%

(a) Calculate operating breakeven point.
(b) Calculate EBIT and earning available for Common.
(c) Calculate DoL; explaining its meaning.
(d) Calculate DFL; " " "
(e) " DTL; " " "
(f) If the Company Can sell additional 15 000 units in the next year. Use leverage to predict changes in EBIT and Earnings available for Common.
Check your work by a simple Calculation of EBIT and earnings available for Common, using the basic info. given.

« Solution »

Q = 30 000 P = $6 Vc = $3.5 FC = $50 000
I = 13000 pD = 7000 T = 40%

(a) operating breakeven point = $\frac{Fc}{P - Vc} = \frac{50\,000}{6 - 3.5}$

= 20 000 units.

(b) EBIT = Q (P - Vc) - FC
= 30 000 (6 - 3.5) - 50 000 = $25 000

Earnings available for Common = (EBIT - I)(1 - T) - pD
= (25000 - 13000)(1 - 40%) - 7000 = $200

(c) $DoL = \frac{Q(P-Vc)}{Q(P-Vc)-Fc} = \frac{30000\ (6-3.5)}{30000\ (6-3.5)-50000} = 3$

for each dollar Δ in Sales, EBIT will change by 3 dollars.

(d) $DFL = \frac{EBIT}{EBIT - I - (\frac{PD}{1-T})} = \frac{25000}{25000 - 13000 - (\frac{7000}{1-40\%})}$

$= 75$

for each dollar Δ in EBIT, Eps will change by 75 dollars.

(e) $DTL = DoL \times DFL = 3 \times 75 = 225$

for each dollar Δ in Sales, Eps will change by 225 dollars.

(f) Additional Sales 15000 units.

% Δ Sales = Additional sales ÷ original sales = 15000 ÷ 30000 = 50%

$DoL = \frac{\%\ \Delta\ EBIT}{\%\ \Delta\ Sales}$ ∴ % Δ EBIT = DoL × % Δ Sales

$= 3 \times 50\% = 150\%$

NEW EBIT = old EBIT (1 + 150%)

$= 25000\ (1 + 150\%) = \$\ 62500$

$DTL = \frac{\%\ \Delta\ Eps}{\%\ \Delta\ Sales}$ ∴ % Δ Eps = DTL × % Δ Sales

$= 225 \times 50\% = 11250\%$

NEW earning available for Common = $200\ (1 + 11250\%) = \$\ 22700$

EBIT = Q (p - Vc) - Fc

= 45000 (6 - 3.5) - 50000 = **$ 62500**

Earning available for Common = (EBIT - I)(1 - T) - PD

= (62500 - 13000)(1 - 40%) - 7000 = **$ 22700**

" Additional problems "

problem (17) :

X Company reported earnings available to common stock of $ 4200000 last year. From those earnings, the company paid a dividend of $ 1.26 on each of its 1000000 common shares outstanding. The capital structure of the company includes 40% debt, 10% preferred stock, and 50% common stock. It is taxed at a rate of 40%.

a- If the market price of the common stock is $ 40 and dividends are expected to grow at rate of 6% per year for the foreseeable Future, what is the company's cost of retained earnings financing?

b- If underpricing and flotation costs on new shares of common stock amount to $ 7 per share, what is the company's cost of new common stock Financing?

c- The company can issue $ 2 dividend preferred stock for a market price of $ 25 per share. Flotation costs would amount to $ 3 per share. What is the cost of preferred stock Financing?

d- The company can issue $ 1000 par value, 10% coupon, 5 year bonds that can be sold for $ 1200 each. Flotation costs would amount to $ 25 per bond. Use the estimation formula to Figure the approximate cost of debt Financing.

e- What is the maximum investment that the company can make in new projects before it must issue new common stock?

f- What is the WACC for projects with a cost at or below the amount calculated in Part e?

g- What is the WACC for projects with a cost above the amount calculated in part e (assuming that debt across all ranges remains at the percentage cost calculated in part d)?

(Solution)

Earnings available to Common	4 200 000
Dividends paid (1.26 x 1000 000)	(1 260 000)
Retained Earnings	2 940 000

$D_0 = 1.26$ $W_d = 40\%$ $W_p = 10\%$ $W_s = 50\%$ $T = 40\%$

(a) $P_0 = 40$ $g = 6\%$ $r_r = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g$

$= \frac{1.26(1+6\%)}{40} + 6\% = 9.339\%$

(b) flotation = $7 $r_n = \frac{D_1}{N_n} + g$

$= \frac{1.26(1+6\%)}{40-7} + 6\% = 10.047\%$

(c) $D_p = \$2$ price \$25 flotation \$3

$$r_p = \frac{D_p}{N_p} = \frac{2}{25-3} = 9.09\%$$

(d) par = \$1000 CR = 10% n = 5 price 1200 flotation 25

$$r_d = \frac{I + \frac{1000 - N_d}{n}}{\frac{N_d + 1000}{2}}$$

$I = 1000 \times 10\% = 100$

$N_d = 1200 - 25 = 1175$

$$= \frac{100 + \frac{1000 - 1175}{5}}{\frac{1175 + 1000}{2}} = \frac{65}{1087.5} = 5.977\%$$

r_i After Tax Cost of debt $= r_d(1-T) = 5.977\%(1-40\%)$

$= 3.586\%$

(e) Max. Inv. before new issue [using Retained Earnings]

$$= \frac{\text{Retained Earnings}}{W_s} = \frac{2\,940\,000}{50\%} = 5\,880\,000$$

(f) $WACC = W_d r_i + W_p r_p + W_s r_r$

$= (40\% \times 3.586\%) + (10\% \times 9.09\%) + (50\% \times 9.339\%)$

$= 7.0129\%$

(g) $WACC_2 = W_d r_i + W_p r_p + W_s r_n$

$= (40\% \times 3.586\%) + (10\% \times 9.09\%) + (50\% \times 10.047\%)$

$= 7.3669\%$

* ممكن بدل المطلوب e ، f ، g يطلب حساب {Marginal} WACC لوعندي مشروع تكلفته المبدئية 7 مليون

Problem 18 DuPree Coffee Roasters, Inc., wishes to expand and modernize its facilities. The installed cost of a proposed computer-controlled automatic-feed roaster will be $130,000. The firm has a chance to sell its 4-year-old roaster for $35,000. The existing roaster originally cost $60,000 and was being depreciated using MACRS and a 7-year recovery period. DuPree is subject to a 40% tax rate.

a. What is the *book value* of the existing roaster?

b. Calculate the after-tax proceeds of the sale of the existing roaster.

c. Calculate the *change in net working capital* using the following data:

Anticipated Changes in Current Assets and Current Liabilities:

Accruals -$20,000, Inventory +50,000, Accounts payable +40,000, Accounts receivable +70,000, Cash 0, Notes payable + 15,000

d. Calculate the *initial investment* associated with the proposed new roaster

Solution (18)

a. Book value = 60000 - ($60,000 × 0.69) = $18,600

b. Recapture of depreciation= Sales price of old equipment - Book value of old equipment
= $35,000 - 18,600 =$16,400

Taxes on recapture of depreciation = $16,400 × 0.40 = $6,560

After-tax proceeds from sale of old roaster = $35,000 – 6560 = $28440

c. Changes in current assets = Inventory $ 50,000 + Accounts receivable 70,000= $ 120,000

Changes in current liabilities=Accruals (20,000) +Accounts payable 40,000+Notes payable 15,000= $ 35,000

Change in net working capital = 120000- 35000= $ 85,000

d. Cost of new roaster= $130,000 + 85000 – 28440 = $186,560

problem (19) :

A Company is Considering investing in one of three mutually Exclusive projects E, F, and G. The firm's Cost of Capital is 15% and risk free rate is 10%.

The firm has gathered the following data :

	project (E)	(F)	(G)
CF0	15000	11000	19000
	Cash inflows		
Year 1-	6000	6000	4000
2.	6000	4000	6000
3.	6000	5000	8000
4.	6000	2000	12000
Risk index	1.8	1	.6

(a) Ignoring risk differences, which is the preferred project?

(b) which project is preferred using RADR ?

Solution (19)

a. project E :

$$NPV = \left[\frac{6000}{(1.15)^1} + \frac{6000}{(1.15)^2} + \frac{6000}{(1.15)^3} + \frac{6000}{(1.15)^4}\right] - 15000$$

$$= 17130 - 15000 = \$\ 2130$$

project F :

$$NPV = \left[\frac{6000}{(1.15)^1} + \frac{4000}{(1.15)^2} + \frac{5000}{(1.15)^3} + \frac{2000}{(1.15)^4}\right] - 11000$$

$$= 12678 - 11000 = \$\ 1678$$

project G :

$$NPV = \left[\frac{4000}{(1.15)^1} + \frac{6000}{(1.15)^2} + \frac{8000}{(1.15)^3} + \frac{12000}{(1.15)^4}\right] - 19000$$

$$= 20144 - 19000 = \$\ 1144$$

→ project (E) with the highest NPV is preferred.

b. project E :

$$RADR = R_F + \beta(r_m - R_F)$$

$$= 10\% + 1.8(15\% - 10\%) = 19\%$$

$$NPV = \left[\frac{6000}{(1.19)^1} + \frac{6000}{(1.19)^2} + \frac{6000}{(1.19)^3} + \frac{6000}{(1.19)^4}\right] - 15000$$

$$= 15834 - 15000 = \$\ 834$$

project F :

$$RADR = 10\% + 1(15\% - 10\%) = 15\%$$

$$NPV = \$\ 1678$$

project G :

$$RADR = 10\% + .6(15\% - 10\%) = 13\%$$

$$NPV \text{ at } 13\% = 21138 - 19000 = \$\ 2138$$

→ project G is preferred in case of using RADR

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